Figure 1

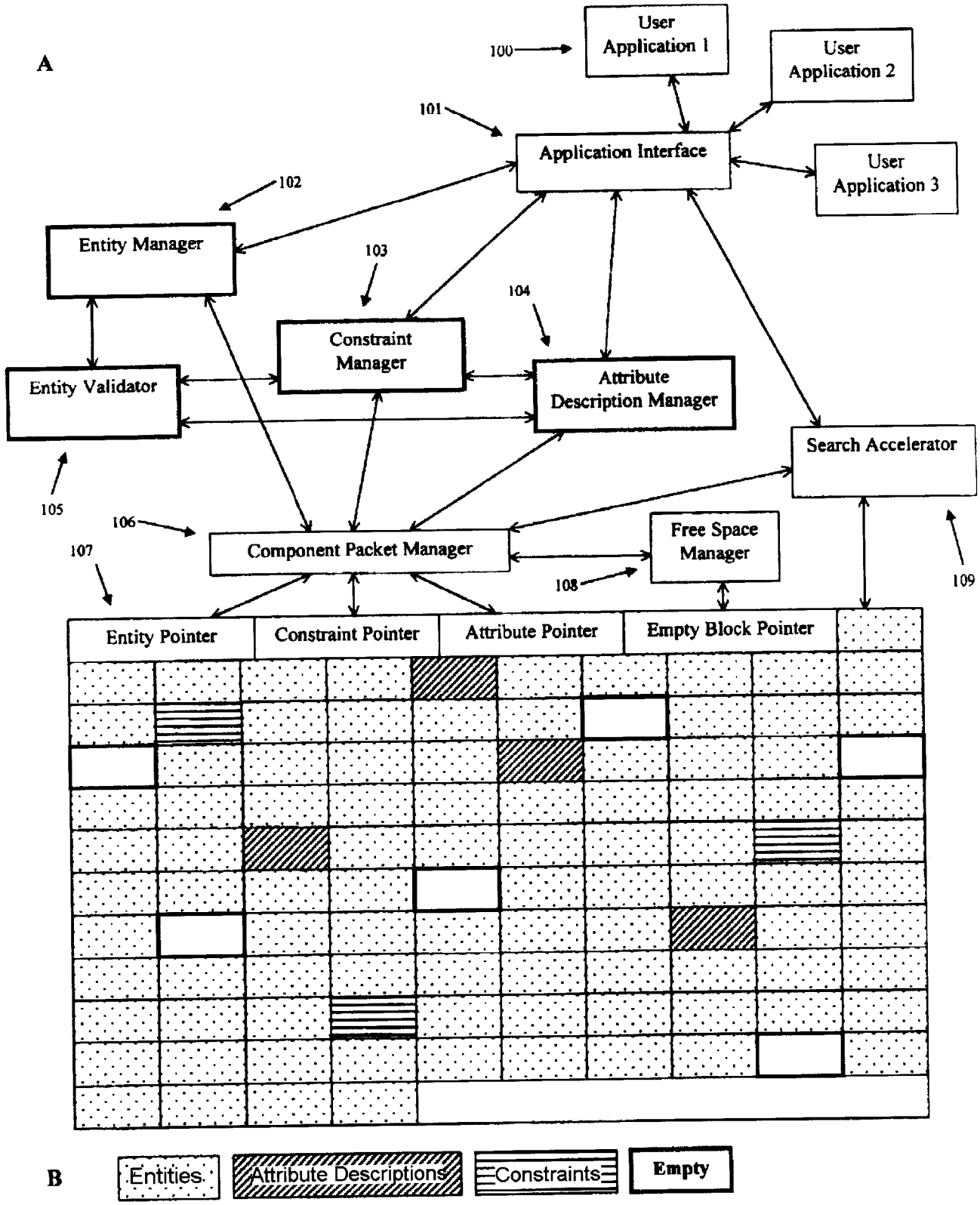

A
100
User Application 1
User Application 2
101
Application Interface
User Application 3
102
Entity Manager
103
104
Constraint Manager
Attribute Description Manager
Entity Validator
Search Accelerator
105
106
Component Packet Manager
Free Space Manager
107
108
109
Entity Pointer
Constraint Pointer
Attribute Pointer
Empty Block Pointer
B
Entities
Attribute Descriptions
Constraints
Empty

Figure 2

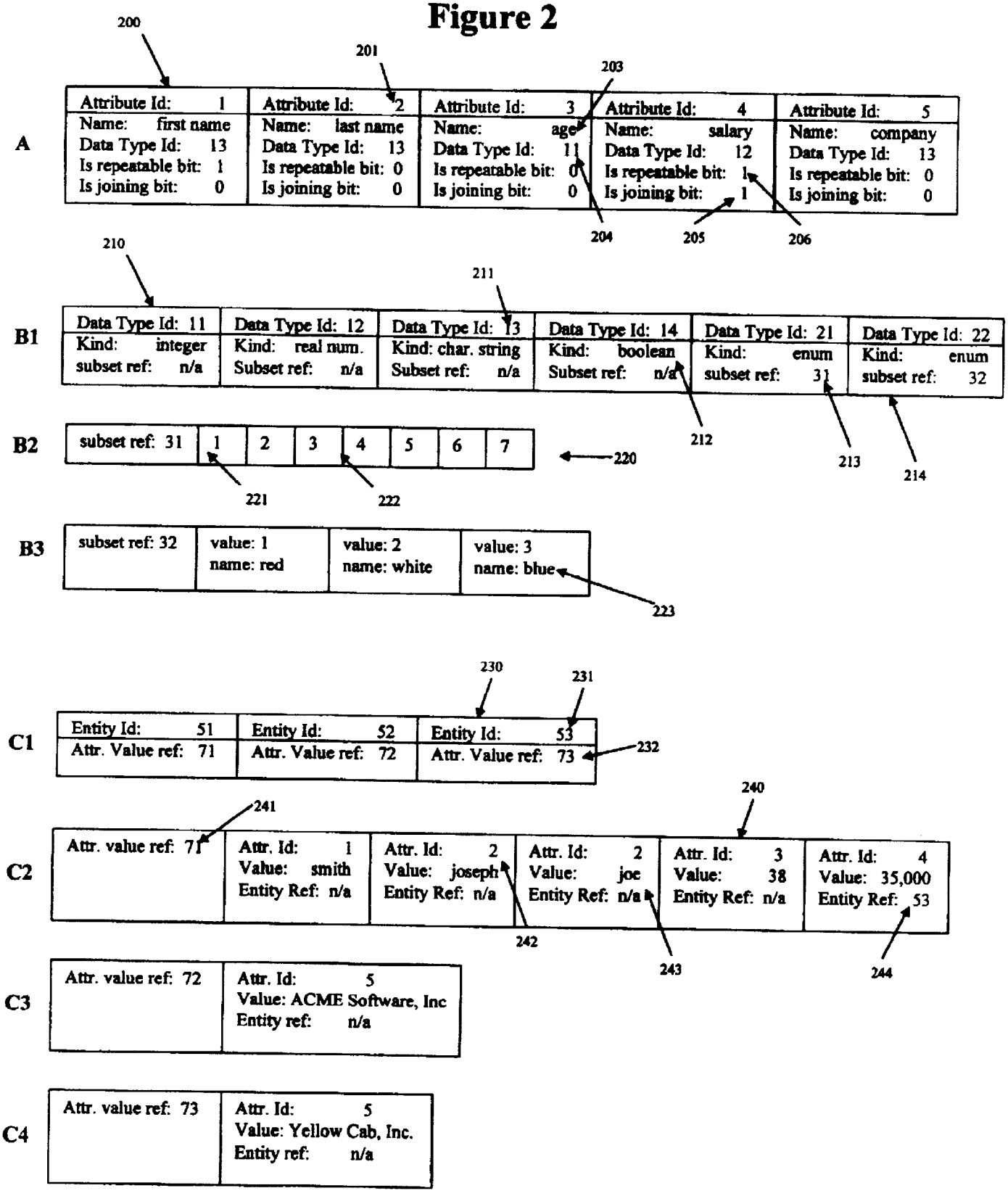

200
201
203
A
Attribute Id: 1
Name: first name
Data Type Id: 13
Is repeatable bit: 1
Is joining bit: 0
Attribute Id: 2
Name: last name
Data Type Id: 13
Is repeatable bit: 0
Is joining bit: 0
Attribute Id: 3
Name: age
Data Type Id: 11
Is repeatable bit: 0
Is joining bit: 0
Attribute Id: 4
Name: salary
Data Type Id: 12
Is repeatable bit: 1
Is joining bit: 1
Attribute Id: 5
Name: company
Data Type Id: 13
Is repeatable bit: 0
Is joining bit: 0
204
205
206
210
211
B1
Data Type Id: 11
Kind: integer
subset ref: n/a
Data Type Id: 12
Kind: real num.
Subset ref: n/a
Data Type Id: 13
Kind: char. string
Subset ref: n/a
Data Type Id: 14
Kind: boolean
Subset ref: n/a
Data Type Id: 21
Kind: enum
subset ref: 31
Data Type Id: 22
Kind: enum
subset ref: 32
212
213
214
B2
subset ref: 31
1
2
3
4
5
6
7
220
221
222
B3
subset ref: 32
value: 1
name: red
value: 2
name: white
value: 3
name: blue
223
230
231
C1
Entity Id: 51
Attr. Value ref: 71
Entity Id: 52
Attr. Value ref: 72
Entity Id: 53
Attr. Value ref: 73
232
240
241
C2
Attr. value ref: 71
Attr. Id: 1
Value: smith
Entity Ref: n/a
Attr. Id: 2
Value: joseph
Entity Ref: n/a
Attr. Id: 2
Value: joe
Entity Ref: n/a
Attr. Id: 3
Value: 38
Entity Ref: n/a
Attr. Id: 4
Value: 35,000
Entity Ref: 53
242
243
244
C3
Attr. value ref: 72
Attr. Id: 5
Value: ACME Software, Inc
Entity ref: n/a
C4
Attr. value ref: 73
Attr. Id: 5
Value: Yellow Cab, Inc.
Entity ref: n/a

Figure 3

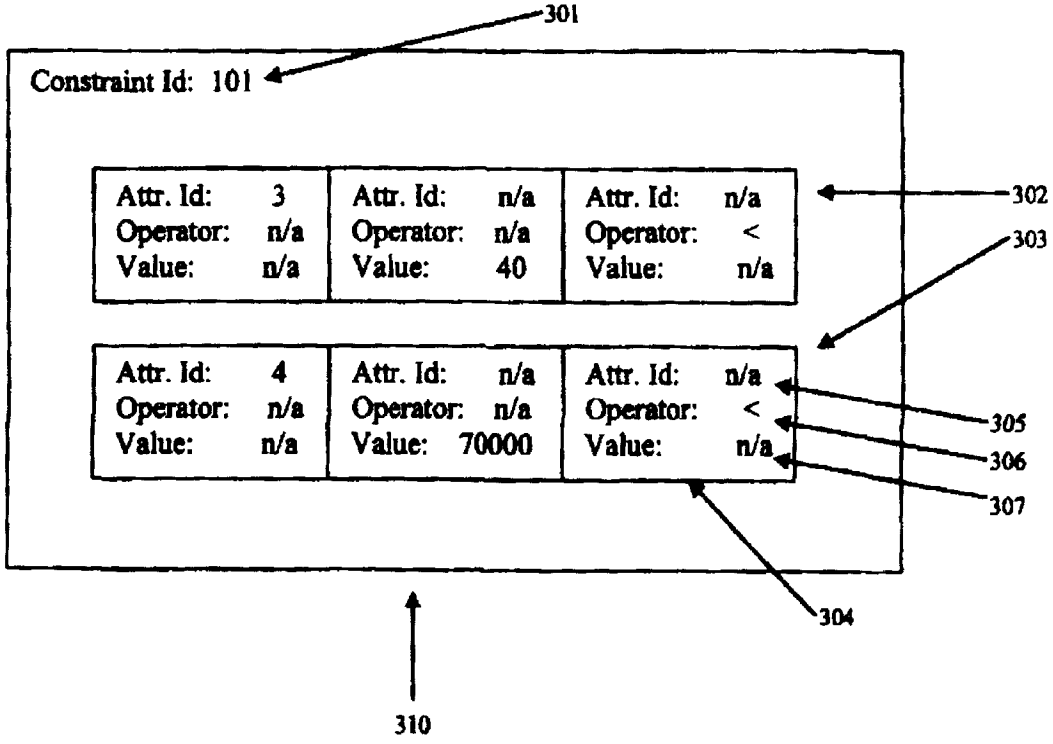


Figure 4

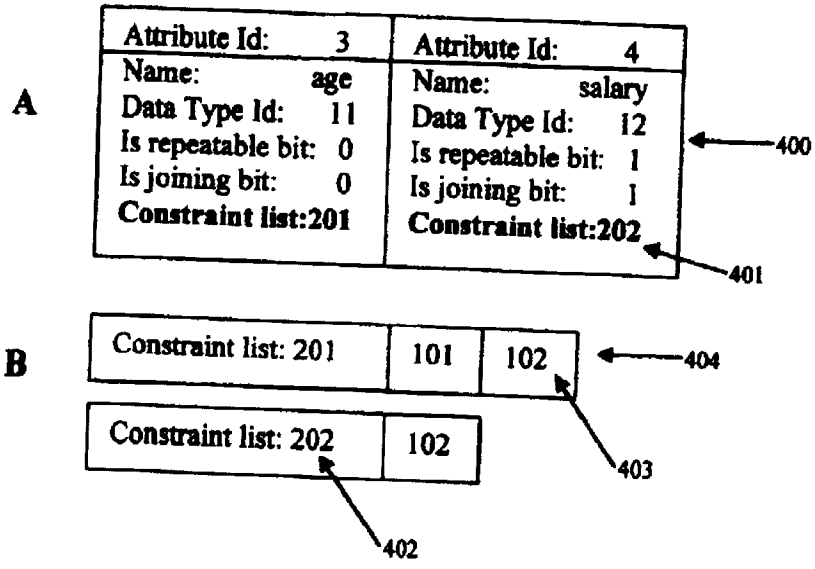


Figure 5

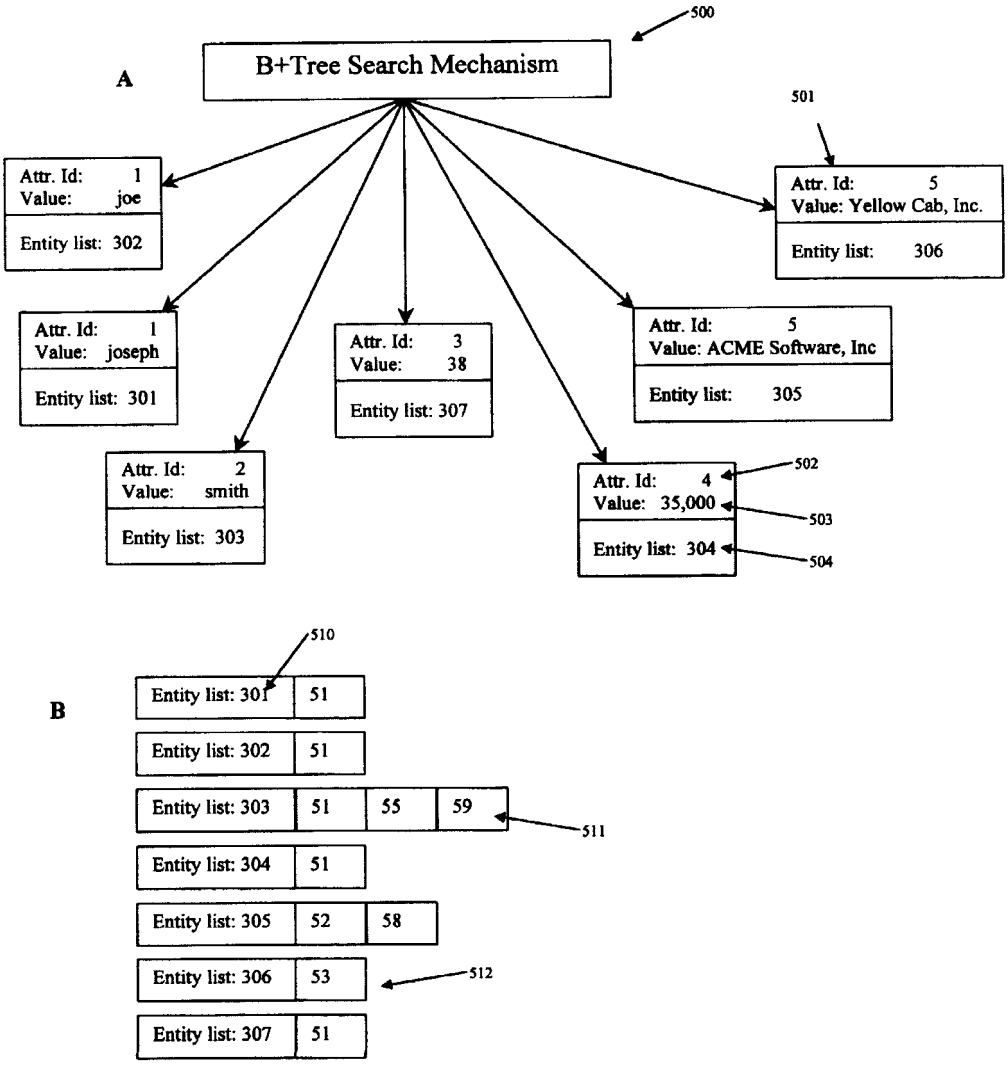
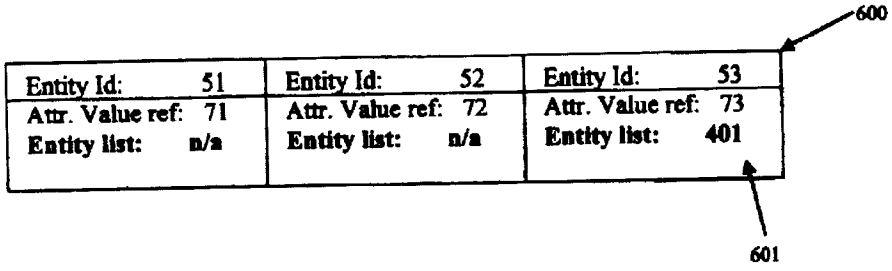

A
B+Tree Search Mechanism
500
501
Attr. Id: 1
Value: joe
Entity list: 302
Attr. Id: 1
Value: joseph
Entity list: 301
Attr. Id: 2
Value: smith
Entity list: 303
Attr. Id: 3
Value: 38
Entity list: 307
Attr. Id: 4
Value: 35,000
Entity list: 304
Attr. Id: 5
Value: ACME Software, Inc
Entity list: 305
Attr. Id: 5
Value: Yellow Cab, Inc.
Entity list: 306
502
503
504
B
510
Entity list: 301 | 51
Entity list: 302 | 51
Entity list: 303 | 51 | 55 | 59
511
Entity list: 304 | 51
Entity list: 305 | 52 | 58
Entity list: 306 | 53
512
Entity list: 307 | 51

Figure 6

A


600
Entity Id: 51
Attr. Value ref: 71
Entity list: n/a
Entity Id: 52
Attr. Value ref: 72
Entity list: n/a
Entity Id: 53
Attr. Value ref: 73
Entity list: 401
601

B

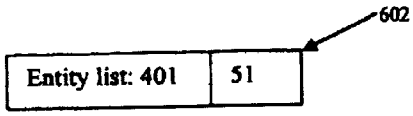

602
Entity list: 401
51

Figure 7

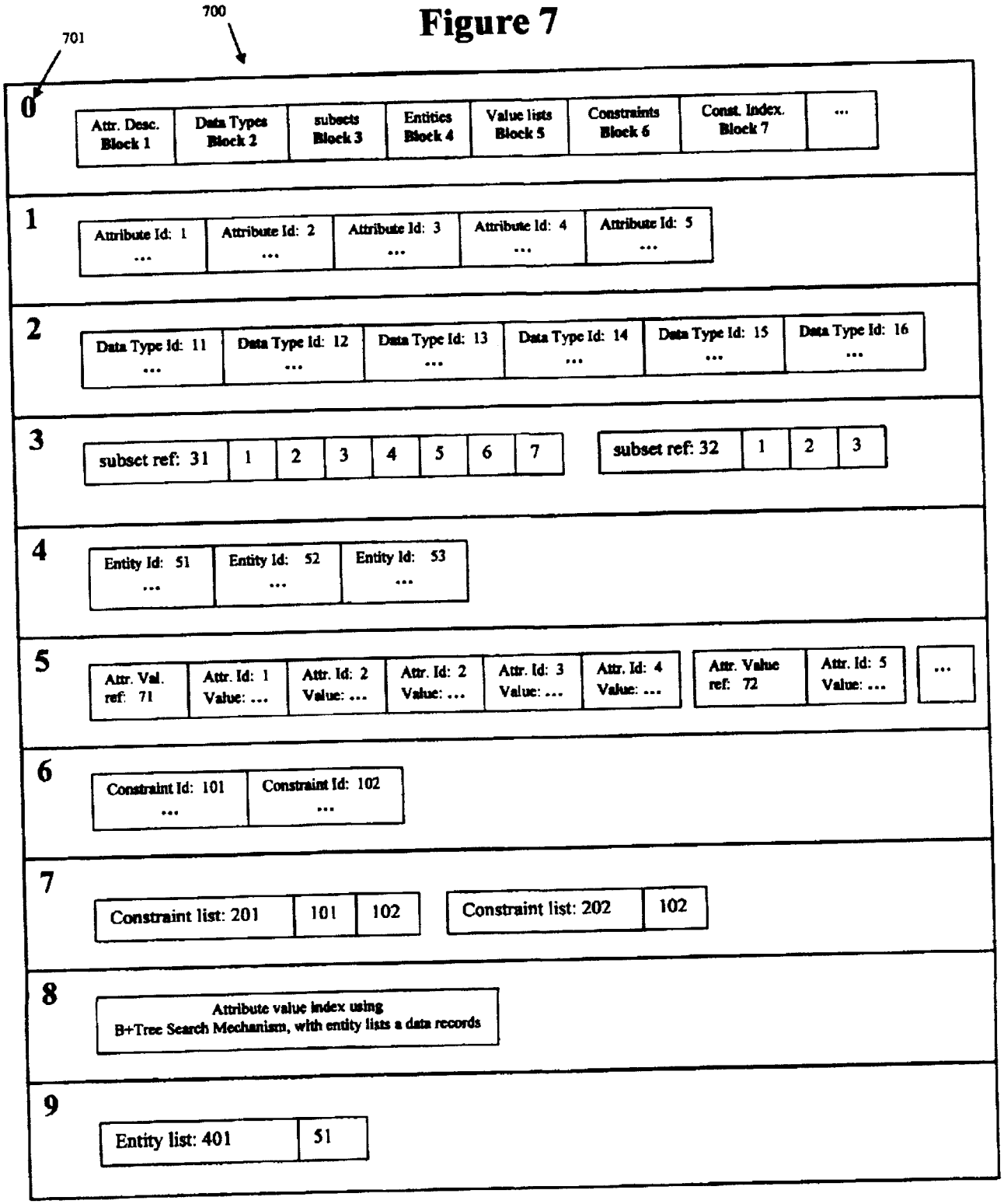
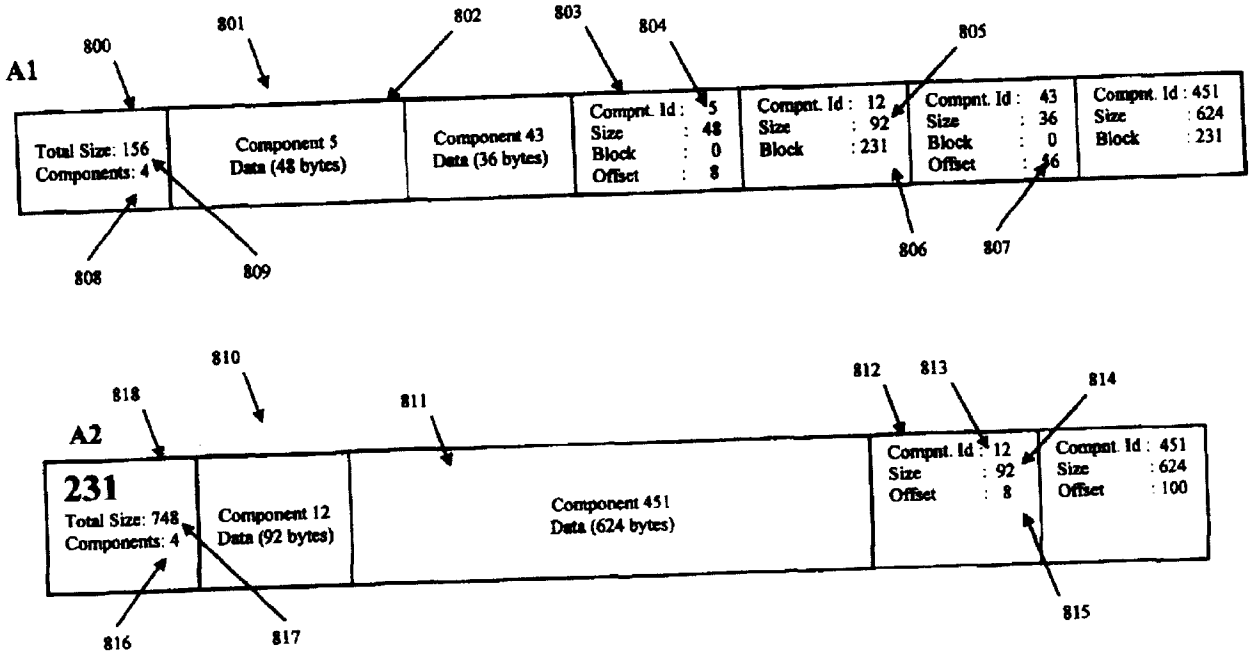
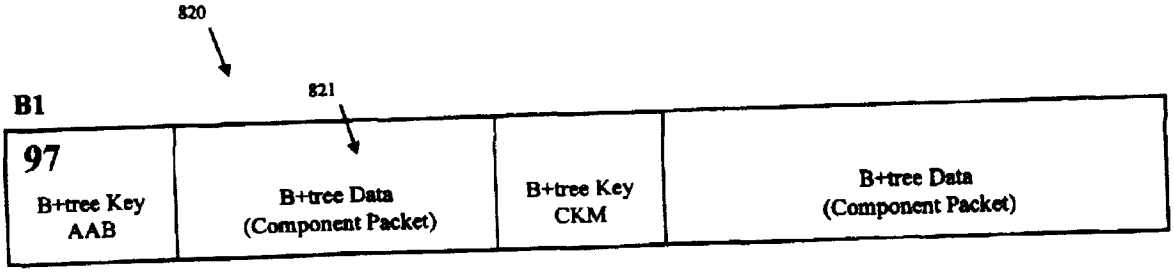

700
701
0
Attr. Desc. Block 1
Data Types Block 2
subsets Block 3
Entities Block 4
Value lists Block 5
Constraints Block 6
Const. Index. Block 7
...
1
Attribute Id: 1 ...
Attribute Id: 2 ...
Attribute Id: 3 ...
Attribute Id: 4 ...
Attribute Id: 5 ...
2
Data Type Id: 11 ...
Data Type Id: 12 ...
Data Type Id: 13 ...
Data Type Id: 14 ...
Data Type Id: 15 ...
Data Type Id: 16 ...
3
subset ref: 31
1
2
3
4
5
6
7
subset ref: 32
1
2
3
4
Entity Id: 51 ...
Entity Id: 52 ...
Entity Id: 53 ...
5
Attr. Val. ref: 71
Attr. Id: 1 Value: ...
Attr. Id: 2 Value: ...
Attr. Id: 2 Value: ...
Attr. Id: 3 Value: ...
Attr. Id: 4 Value: ...
Attr. Value ref: 72
Attr. Id: 5 Value: ...
...
6
Constraint Id: 101 ...
Constraint Id: 102 ...
7
Constraint list: 201
101
102
Constraint list: 202
102
8
Attribute value index using B+Tree Search Mechanism, with entity lists a data records
9
Entity list: 401
51

Figure 8


A1
800
801
802
803
804
805
Total Size: 156
Components: 4
Component 5
Data (48 bytes)
Component 43
Data (36 bytes)
Compnt. Id : 5
Size : 48
Block : 0
Offset : 8
Compnt. Id : 12
Size : 92
Block : 231
Compnt. Id : 43
Size : 36
Block : 0
Offset : 96
Compnt. Id : 451
Size : 624
Block : 231
806
807
808
809
A2
810
811
812
813
814
818
231
Total Size: 748
Components: 4
Component 12
Data (92 bytes)
Component 451
Data (624 bytes)
Compnt. Id : 12
Size : 92
Offset : 8
Compnt. Id : 451
Size : 624
Offset : 100
815
816
817


820
B1
821
97
B+tree Key
AAB
B+tree Data
(Component Packet)
B+tree Key
CKM
B+tree Data
(Component Packet)

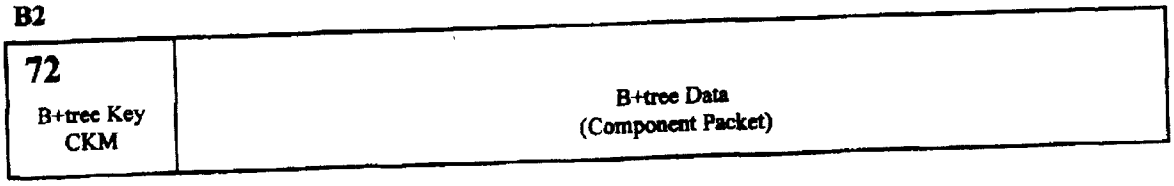
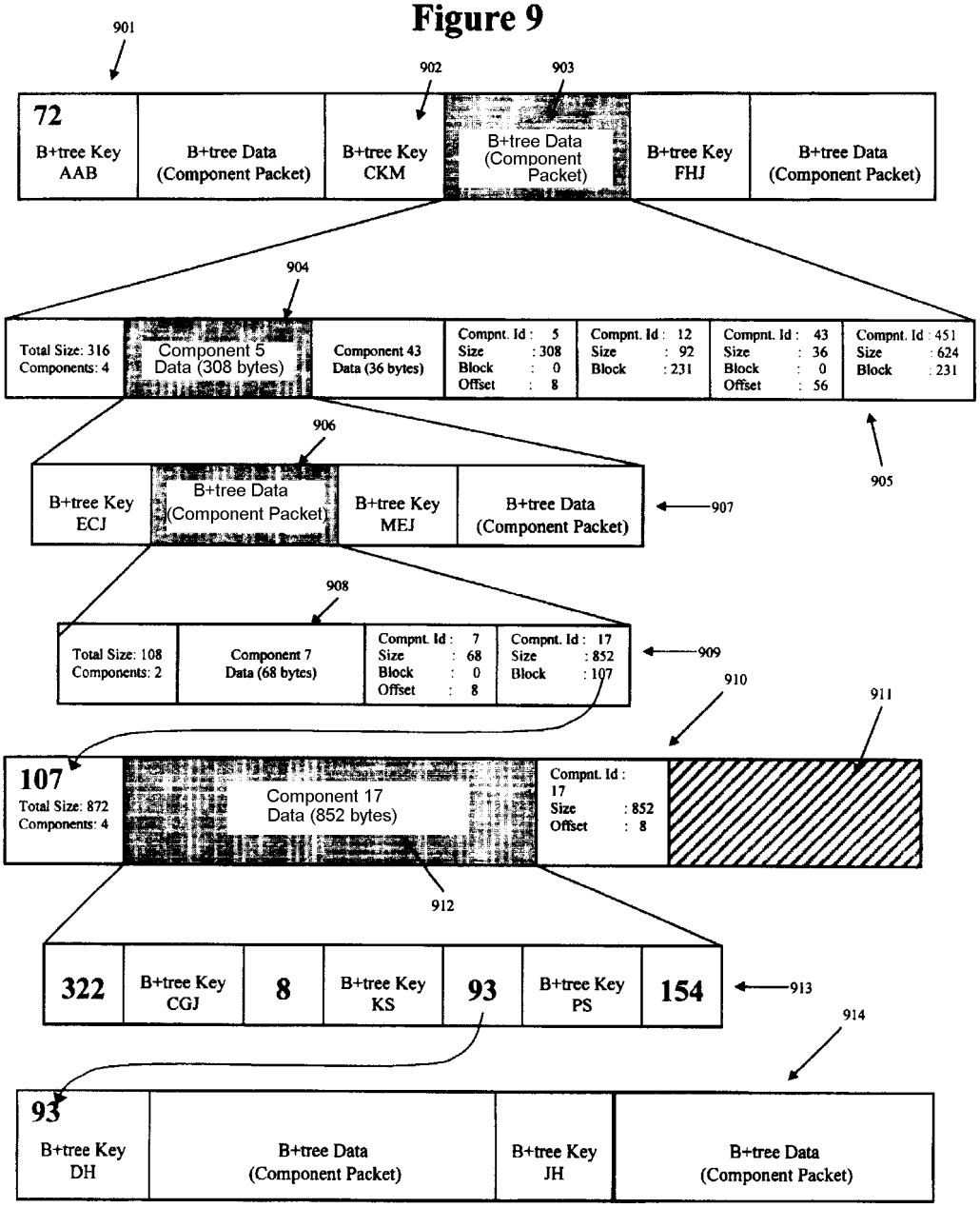

B2
72
B+tree Key
CKM
B+tree Data
(Component Packet)

Figure 9


901
902
903
72
B+tree Key AAB
B+tree Data (Component Packet)
B+tree Key CKM
B+tree Data (Component Packet)
B+tree Key FHJ
B+tree Data (Component Packet)
904
Total Size: 316
Components: 4
Component 5 Data (308 bytes)
Component 43 Data (36 bytes)
Compnt. Id : 5
Size : 308
Block : 0
Offset : 8
Compnt. Id : 12
Size : 92
Block : 231
Compnt. Id : 43
Size : 36
Block : 0
Offset : 56
Compnt. Id : 451
Size : 624
Block : 231
905
906
B+tree Key ECJ
B+tree Data (Component Packet)
B+tree Key MEJ
B+tree Data (Component Packet)
907
908
Total Size: 108
Components: 2
Component 7 Data (68 bytes)
Compnt. Id : 7
Size : 68
Block : 0
Offset : 8
Compnt. Id : 17
Size : 852
Block : 107
909
910
911
107
Total Size: 872
Components: 4
Component 17 Data (852 bytes)
Compnt. Id : 17
Size : 852
Offset : 8
912
322
B+tree Key CGJ
8
B+tree Key KS
93
B+tree Key PS
154
913
914
93
B+tree Key DH
B+tree Data (Component Packet)
B+tree Key JH
B+tree Data (Component Packet)